ATTACHMENT E

Quench Tower Particulate Emission Rates

At a meeting with IDEM on April 14, 1992, a question was raised concerning the quench tower particulate emission rates used by ENSR in the compliance modeling analysis. Specifically, the Department's concern was that the emission rate used underestimated the actual emission rate due to TDS in the quench water which is evaporated during the quenching process. In addition the validity of the TRC emission tests was questioned.

The following is an analysis of the Department's comment that the emissions, as reported by TRC, underestimate the actual particulate emission rate due to the TDS in the evaporated quench water.

Step 1: Calculate the uncontrolled total suspended particulate (TSP) emissions due to TDS in evaporated quench water.

From the TRC report and US Steel operating data:

Test	Quench Water TDS(1) (mg/l)	TSP Emission Rate(2) (lb/quench)	Water Evaporated (gal/quench)
Tower #3 Clean Makeup	494	11.5	3510
Tower #3 Dirty Makeup	1752	15.0	3510
Tower #5 Clean Makeup	488	3.8	1350
Tower #5 Dirty Makeup	2299	7.7	1350

(1) Quench water as applied.
(2) Total particulates.

Uncontrolled particulate emissions from the applied quench water (assuming all TDS in the evaporated quench water is emitted and no particles attach to the coke) is equal to the amount of water evaporated during a quench times the concentration of solids (i.e., TDS) in the applied quench water. Based on the above assumptions, uncontrolled particulate emissions per quench due to TDS in the evaporated quench water for each of the TRC tests is calculated as follows:

Tower #3 Clean Makeup

494 mg/l * 3510 gal/quench * 3.785 l/gal * 1/453,590 lb/mg = 14.5 lb TSP/quench

Tower #3 Dirty Makeup

1752 mg/l * 3510 gal/quench * 3.785 l/gal * 1/453590 lb/mg = 51.3 lb TSP/quench

Tower #5 Clean Makeup

488 mg/l * 1350 gal/quench * 3.785 l/gal * 1/453590 lb/mg = 5.5 lb TSP/quench

Tower #5 Dirty Makeup

2299 mg/l * 1350 gal/quench * 3.785 l/gal * 1/453590 lb/mg = 25.9 lb TSP/quench

Step 2: Calculate controlled emissions due to TDS in evaporated quench water

The emission rate computed in Step 1 is uncontrolled. The quench tower baffles provide a measure of control. To estimate the baffle control efficiency, AP-42 emission factors were used. From AP-42 Table 7.2-1, Quenching Emission Factors (lb of TSP per ton of coke):

EF RATING — Cumulative Mass Emission Factors all ≤ 100% 30 μm

D	Uncontrolled Dirty Makeup:	1.19	5.24
B	Uncontrolled Clean Makeup:	0.34	1.13
D	Controlled (Baffles) Dirty Makeup:	0.42	1.30
D	Controlled (Baffles) Clean Makeup :	0.05	0.54

The implied baffle control efficiency based on AP-42 emission factors is therefore:

(0.34 - 0.05)/0.34 = 85.3%

Clean Makeup (1.13-0.54)/1.13 = 52% control efficiency
Dirty Makeup (5.24-1.30)/5.24 = 75% control efficiency

(1.19 - 0.42)/1.19 = 64.7%

Utilizing the above control efficiencies, the controlled particulate emission rates calculated in Step 1 due to TDS in evaporated quench water are calculated as follows:

Tower #3 Clean Makeup:

14.5 lbs/quench * (1-0.52 control efficiency) = 7.0 lb TSP/quench

Tower #3 Dirty Makeup:

51.3 lbs/quench * (1-0.75 control efficiency) = 12.8 lb TSP/quench

(1 - 0.647) = 18.1 #/Q

Tower #5 Clean Makeup:

5.5 lbs/quench * (1-0.52 control efficiency) = 2.6 lb TSP/quench

Tower #5 Dirty Makeup:

25.9 lbs/quench * (1-0.75 control efficiency) = 6.5 lb TSP/quench

(1-0.647) ≈ 9.14

The following table compares the estimated TSP emissions due to TDS in the evaporated quench water with the measured particulates from the TRC report.

Test	Measured TSP Emission Rate (lbs/quench)	Estimated TSP Emission Rate (lbs/quench)	
Tower #3 Clean Makeup	11.5	7.0	
Tower #3 Dirty Makeup	15.0	~~12.8~~ 18.1	21% greater
Tower #5 Clean Makeup	3.8	2.6	
Tower #5 Dirty Makeup	7.7	~~6.5~~ 9.1	18% greater

In each case the estimated TSP emission rate due to TDS in the evaporated quench water is less than the measured TSP emission rate. The differences are attributable to additional particulates which are emitted as coke fines created during the coke cooling process. Based on this analysis, the particulate emission test performed by TRC does not underestimate the actual emissions.

ATTACHMENT F

REVISED USS GARY WORKS PM_{10} EMISSION INVENTORY

SOURCES INCLUDED IN DISPERSION MODELING ANALYSIS

TABLE 2-1

COKE PLANT PM_{10} EMISSION RATES

Source Number	Source Name	PM_{10} Emission Rate	
		ENSR (lb/hr)(1)	ENSR (tons/yr)(2)
94001	#2 Precarbon Precipitator	7.5	32.8
94002	#2 Precarbon Coal Tower Baghouse	2.1	9.2
94003	#2 Precarbon Preheat Baghouse	2.2	9.6
94004	#3 Precarbon Precipitator	4.2	18.4
94005	#3 Precarbon Coal Tower Baghouse	6.4	28.0
94024	#2/#3 Quench Tower	39.2	171.7
94026	Coke Battery #2 Underfire Stack	27.5	120.5
94027	Coke Battery #3 Underfire Stack	42.1	184.4
94028	#5 Quench Tower	21.2	92.9
94029	#5 Coke Battery Underfire Stack	16.8	73.6
94030	#7 Coke Battery Underfire Stack	20.4	89.4
94101/94102	#2 Coke Battery Fugitives	7.0	30.7
94103/94104	#3 Coke Battery Fugitives	6.4	28.0
94105/94106	#5 Coke Battery Fugitives	2.3	10.1
94107/94108	#7 Coke Battery Fugitives	2.4	10.5

(1) An explanation of the calculation of these emission rates can be found in Appendix B.
(2) Based on 8,760 hours of operation.

TABLE 2-2

SINTER PLANT PM_{10} EMISSION RATES

Source Number	Source Name	PM_{10} Emission Rate	
		ENSR (lb/hr)[1]	ENSR (tons/yr)[2]
94007	#3 Sinter Plant Coolers	152.8	217.7
94008	#3 Sinter Plant Discharge Baghouse	7.2	10.5
94009	Sinter Screening Baghouse	1.3	1.7
94010	Sinter Storage Baghouse	1.3	3.2
94011	#3 Sinter Windbox	165.0	235.1
94053	#3 Sinter Plant S1/S2 Baghouse	0.8	1.2
94130	#3 Sinter Plant S1/S2 Baghouse Fugitives	4.4	6.2

(1) An explanantion of the calculation of these emission rates can be found in Appendix B. Assumes two of three lines operating.
(2) Based on 4,992 hours of operation per year.

TABLE 2-3

BLAST FURNACE PM_{10} EMISSION RATES

Source Number	Source Name	PM_{10} Emission Rate	
		ENSR (lb/hr)[1]	ENSR (tons/yr)[2]
94020	Blast Furnace Stoves #13	21.2	92.9
94021	Blast Furnace Stoves #4	11.6	50.8
94022	Blast Furnace Stoves #6	11.6	50.8
94023	Blast Furnace Stoves #7/#8	11.6[4]	0.0
94055	#13 Blast Furnace Sinter Screening Baghouse	2.5	10.9
94116-94118	#4 Blast Furnace Casthouse Fugitives	6.8	26.7
94119-94121	#6 Blast Furnace Casthouse Fugitives	6.8	24.5
94122-94124	#7 Blast Furnace Casthouse Fugitives	0.0	0.0
94125-94127	#8 Blast Furnace Casthouse Fugitives	5.5	0.0
94128-94129	#13 Blast Furnace Casthouse Fugitives	31.2	117.4

(1) An explanantion of the calculation of these emission rates can be found in Appendix B. ENSR short-term emission rate assumes that the #7 Blast Furnace will not operate in conjunction with the #13 Blast Furnace.

(2) Based on maximum annual production of 6.6 x 10^{-6} tpy of hot metal and the following daily average production rates:

#4 BF	4,800 TPD
#6 BF	4,400 TPD
#8 BF	0 TPD
#13 BF	9,000 TPD

TABLE 2-4

BOP AND Q-BOP SHOP PM_{10} EMISSION RATES

Source Number	Source Name	PM_{10} Emission Rate	
		ENSR (lb/hr)[(1)]	ENSR (tons/yr)[(2)]
94041	#1 BOP Iron Desulfurization Baghouse	9.3	36.8
94042	#2 Q-BOP Hot Metal Desulfurization Baghouse	11.5	50.4
94043	Lime Baghouse	2.6	11.4
94045	#1 BOP Gas Cleaning	34.4	121.8
94046	#2 Q-BOP Gas Cleaning	32.0	111.7
94052	New #2 Q-BOP Secondary Baghouse	25.9	113.4
94054	LMF Baghouses	2.9	12.7
94113/94114	#1 BOP Fugitives (maximized Q-BOP Production)[(3)]	52.9	209.4
94115	#2 Q-BOP Fugitives Uncontrolled (maximized Q-BOP Production)[(3)]	92.5	323.2
94115	#2 Q-BOP Fugitives Controlled (maximized Q-BOP Production)[(3)]	22.6	99.0

(1) An explanation of the calculation of these emission rates can be found in Appendix B.
(2) Based on maximum annual steel production limit of 7.5×10^6 tpy. Emission rates based on daily annual production rates of 10,570 tons per day at the Q-BOP and 9,715 tons per day at the BOP.
(3) The maximized Q-BOP production scenario allows for daily maximum production of 13,250 tons per day at the Q-BOP and 10,750 tons per day at the BOP.

TABLE 2-5

BOILER PM_{10} EMISSION RATES

Source Number	Source Name	PM_{10} Emission Rate ENSR (lb/hr)[1]	ENSR (tons/yr)[2]
94012	#4 Boiler House	39.5[4]	173.0
94014	160"/210" Plate Mill Continuous Furnace	4.4	19.3
94017	84" Hot Strip Mill Reheat Boilers	11.1	48.6
94018	84" Hot Strip Mill Waste Heat Boiler #1	2.1	9.0
94019	84" Hot Strip Mill Waste Heat Boiler #2	2.1	9.0
94037	#2 Coke Plant Boilers #4/#5	10.0	43.8
94038	#2 Coke Plant Boiler #6	3.2	14.0
94039	#2 Coke Plant Boiler #7	1.8	7.9
94050	Turboblower Boiler #6	16.5	72.3
94051	Turboblower Boilers #1-5	41.9	183.5

(1) An explanantion of the calculation of these emission rates can be found in Appendix B.
(2) Based 8,760 hours of operation at maximum load.

TABLE 2-6

PM_{10} EMISSION RATES FOR ADDITIONAL SOURCES

Source Number	Source Name	PM_{10} Emission Rate	
		ENSR (lb/hr)(1)	ENSR (tons/yr)(2)
94131	Torch Cut-off Machine	1.7	7.4
94132	Slab Mill Keep Hot Furnace	0.2	0.9
94133	Plate Mill Slow Cool Furnace	0.2	0.9
94555/56	Beach Iron	9.7	7.0
94557	Scrap Sizing	2.7	2.3

(1) An explanation of the calculation of these emission rates can be found in Appendix B.
(2) Based on 8,760 hours of operation.

ATTACHMENT G

REVISED USS GARY WORKS PM_{10} EMISSION INVENTORY

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Table B–1
PM–10 Emission Rates
USS Gary Works – Coke Plant

Source	Modeling InventoryNo.	TSP Emission Factor (lb/ton)	Maximum Throughput(tons/hr) (1)	Control Device (2)	Control Efficiency(%)	PM–10% of TSP (2)	Emission Rate (lb/hr)
Battery #2 Underfire	94026	––––	140.2 Coal	None	––––	100	27.5 (3)
Battery #3 Underfire	94027	––––	129.1 Coal	None	––––	100	42.1 (3)
Battery #5 Underfire	94029	––––	50.5 Coal	None	––––	100	16.8 (3)
Battery #7 Underfire	94030	––––	52.1 Coal	None	––––	100	20.4 (3)
Battery #2 Fugitives	94101–2	0.040 (4)	140.2 Coal	Stg Charge,Scrub Car	0	(4)	7.0 (4)
Battery #3 Fugitives	94103–4	0.040 (4)	129.1 Coal	Stg Charge,Scrub Car	0	(4)	6.4 (4)
Battery #5 Fugitives	94105–6	0.107 (4)	50.5 Coal	Stg Charge, Baghouse	0	(4)	2.3 (4)
Battery #7 Fugitives	94107–8	0.107 (4)	52.1 Coal	Stg Charge, Baghouse	0	(4)	2.4 (4)
Quench Tower #2	94024	0.450 (5)	140.2 Coal	Baffles	0	32.3	20.4 (5)
Quench Tower #3	94024	0.450 (5)	129.1 Coal	Baffles	0	32.3	18.8 (5)
Quench Tower #5 (6)	94028	0.640 (5)	102.6 Coal	Baffles	0	32.3	21.2 (5)
#2 Precarbon Precip	94001	––––	––––	ESP	99	100	7.5 (2)
#2 Precarbon Baghouse	94002	––––	––––	Baghouse	99	100	2.1 (2)
#2 Preheat Baghouse	94003	––––	––––	Baghouse	99	100	2.2 (2)
#3 Precarbon Precip	94004	––––	––––	ESP	99	100	4.2 (2)
#3 Precarbon Baghouse	94005	––––	––––	Baghouse	99	100	6.4 (2)
#3 Preheat Baghouse	––––	––––	––––	Baghouse	99	100	0.2 (7)
					Total PM–10 Emission Rate		207.9

(1) Per ENSR meeting with USS, 1/17/92.
(2) From 12/6/89 IDEM emission inventory.
(3) Emission rate derived from stack test.
(4) See Table B–2.
(5) See Table B–3.
(6) Serves batteries Nos. 5 and 7.
(7) Not modeled.

TABLE B-2
WORKSHEET TO ESTIMATE FUGITIVE PM10 EMISSIONS FROM BATTERY OPERATIONS

SOURCE	Operation	Maximum Feed Rate (tons/hr)	TSP Emission Factor (lb/ton chrged)	Fraction PM-10	PM-10 Emissions (lbs/hr)	Comments
Battery #2						
	Charging	140.2	0.008	1.00	1.12	AP-42 EF for stage charging of battery.
	Door leaks	140.2	0.008	1.00	1.12	EF from ENSR Clairton report.
	Pushing	140.2	0.023	1.00	3.22	EF from AP-42 with Scrubber Car. PM-10 % from AP-42.
	Pushing fugives	140.2	0.023	0.433	1.39	Fugitive pushing emissions not captured by scrubber cars. Based on AP-42 uncontrolled pushing EF and 98% control efficiency.
	Lids & Offtakes	140.2	0.001	1.00	0.14	EF 10% of USEPA letter to LCTF. Worst case PM-10 %. 90% less USEPA EF due to battery leak detection program.
Subtotal Battery #2			0.063		7.00	
Battery #3						
	Charging	129.1	0.008	1.00	1.03	AP-42 EF for stage charging of battery.
	Door leaks	129.1	0.008	1.00	1.03	EF from ENSR Clairton report.
	Pushing	129.1	0.023	1.00	2.97	EF from AP-42 with Scrubber Car. PM-10 % from AP-42.
	Pushing fugives	129.1	0.023	0.433	1.28	Fugitive pushing emissions not captured by scrubber cars. Based on AP-42 uncontrolled pushing EF and 98% control efficiency.
	Lids & Offtakes	129.1	0.001	1.00	0.13	EF 10% of USEPA letter to LCTF. Worst case PM-10 %. 90% less USEPA EF due to battery leak detection program.
Subtotal Battery #3			0.063		6.44	
Battery #5						
	Charging	50.5	0.008	1.00	0.40	AP-42 EF for stage charging of battery.
	Door leaks	50.5	0.008	1.00	0.40	EF from ENSR Clairton report.
	Pushing	50.5	0.090	0.32	1.45	EF from AP-42. Baghouse controlled. PM-10 % from IDEM.
	Lids & Offtakes	50.5	0.001	1.00	0.05	EF 10% of USEPA letter to LCTF. Worst case PM-10 %. 90% less USEPA EF due to battery leak detection program.
Subtotal Battery #5			0.107		2.31	
Battery #7						
	Charging	52.1	0.008	1.00	0.42	AP-42 EF for stage charging of battery.
	Door leaks	52.1	0.008	1.00	0.42	EF from ENSR Clairton report.
	Pushing	52.1	0.090	0.32	1.50	EF from AP-42. Baghouse controlled. PM-10 % from IDEM.
	Lids & Offtakes	52.1	0.001	1.00	0.05	EF 10% of USEPA letter to LCTF. Worst case PM-10 %. 90% less USEPA EF due to battery leak detection program.
Subtotal Battery #7			0.107		2.39	
			Total PM-10 Emission Rate		18.14	

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TABLE B-3
WORKSHEET TO ESTIMATE FUGITIVE PM10 EMISSIONS FROM THE QUENCH TOWER OPERATIONS

Source	Battery Served	Maximum Feed Rate (tons/hr coal)	Emission Factor (lbs/ton chrged)	Fraction PM-10	PM-10 Emissions (lbs/hr)	Comments
Quench #2	2	140.2	0.45	0.323	20.4	EF from IDEM. PM-10 fraction from AP-42 (dirty water, baffles)
Quench #3	3	129.1	0.45	0.323	18.8	EF from IDEM. PM-10 fraction from AP-42 (dirty water, baffles)
Quench #5	5,7	102.6	0.64	0.323	21.2	EF from IDEM. PM-10 fraction from AP-42 (dirty water, baffles)
Total PM-10 Emission Rate					60.4	

Table B-4
PM-10 Emission Rates
USS Gary Works - Sinter Plant

Source	Modeling InventoryNo.	Maximum Throughput(tons/hr) (1)	Control Device (2)	Control Efficiency(%)	PM-10% of TSP	ST Emission Rate (lb/hr) (3)	LT Emission Rate (lb/hr) (4)
Line 1W Windbox	94011	160 Sinter	Scrubber, ESP	95	(2)	82.5 (5)	47.1 (5)
Line Center Windbox	94011	160 Sinter	Scrubber, ESP	95	(2)	82.5 (5)	47.1 (5)
Line 1E Windbox	94011	0 Sinter	Scrubber, ESP	95	(2)	0.0	0.0
Line 1W Baghouse	94008	160 Sinter	Baghouse	99	32	3.6 (6)	2.1 (6)
Line Center Baghouse	94008	160 Sinter	Baghouse	99	32	3.6 (6)	2.1 (6)
Line 1E Baghouse	94008	0 Sinter	Baghouse	99	32	0.0	0.0
Line 1W Cooler	94007	160 Sinter	Baghouse	76.1	(2)	76.4 (7)	43.6 (7)
Line Center Cooler	94007	160 Sinter	Baghouse	76.1	(2)	76.4 (7)	43.6 (7)
Line 1E Cooler	94007	0 Sinter	Baghouse	76.1	(2)	0.0	0.0
Screening Sta. Baghouse	94009		Baghouse	99	100	1.3	0.7
Storage Bin Baghouse	94010		Baghouse	99	100	1.3	1.3
S1/S2 Baghouse	94053		Baghouse	99	100	0.8 (6)	0.5 (6)
S1/S2 Baghouse Fug.	94130			---	100	4.4 (6)	2.5 (6)
				Total PM-10 Emission Rate		332.8	190.6

(1) Per ENSR meeting with USS, 1/17/92, only two lines will operate simultaneously.
(2) Based on ratio of PM10 stack test results to existing TSP emissions limit.
(3) Short-term emission rate represents a maximum hourly emission rate based on maximum hourly production.
(4) Long-term emission rate represents an average hourly emission rate and are derived by multiplying the ratio of the old annual production to the new annual production by the ST emission rate. For example, for the Line 1W Windbox (1.6E06 tons/yr / 2.8E06tons/yr) X 82.5 lb/hr = 47.3 lb/hr.
(5) Emission rate derived from 3 stack tests (12/87).
(6) IDEM Emission rate.
(7) Emission rate derived from 3 stack tests (12/88).

Table B-5
PM-10 Emission Rates
USS Gary Works - Blast Furnaces

Source	Modeling Inventory No.	TSP Emission Factor (1)	Throughput/Capacity (2) Hourly Max.	Hourly Avg.	Control Device (3)	PM-10 % of TSP (3)	ST Emission Rate (lb/hr) (4)	LT Emission Rate (lb/hr) (5)
BF #4 Stoves	94021	0.029 lb/MMBtu	400 MMBtu/hr	----	Process Venturi	100	11.6	11.6
BF #6 Stoves	94022	0.029 lb/MMBtu	400 MMBtu/hr	----	Process Venturi	100	11.6	11.6
BF #7 Stoves	94023	0.029 lb/MMBtu	400 MMBtu/hr	----	Process Venturi	100	0.0	0.0
BF #8 Stoves	94023	0.029 lb/MMBtu	400 MMBtu/hr	----	Process Venturi	100	11.6	0.0
BF #13 Stoves	94020	0.015 lb/MMBtu	1411 MMBtu/hr	----	Process Venturi	100	21.2	21.2
BF #13 Sinter Screen	94055	----	----	----	Baghouse	100	2.5	2.5
BF #4 Casthouse	94116-118	0.06 lb/ton hot metal	220.833 tons hot metal/hr	200.0 tons hot metal/hr	Fume Suppresion	51	6.8	6.1
BF #6 Casthouse	94119-121	0.06 lb/ton hot metal	220.833 tons hot metal/hr	183.3 tons hot metal/hr	Fume Suppresion	51	6.8	5.6
BF #7 Casthouse	94122-124	0.06 lb/ton hot metal	0.0 tons hot metal/hr	0.0 tons hot metal/hr	Fume Suppresion	51	0.0	0.0
BF #8 Casthouse	94125-127	0.06 lb/ton hot metal	180.0 tons hot metal/hr	0.0 tons hot metal/hr	Fume Suppresion	51	5.5	0.0
BF #13 Casthouse	94128-129	0.14 lb/ton hot metal	437.5 tons hot metal/hr	375.0 tons hot metal/hr	Fume Suppresion	51	31.2	26.8
					Total PM-10 Emission Rate		108.7	85.4

(1) Emission factor of 0.029 lb/MMBtu from AP-42 emission factor for blast furnace gas, factor of 0.015 lb/MMBtu derived from mix of 89.5% BFG and 10.5% NG. Casthouse emission factor from AP-42.
(2) Per ENSR meeting with USS, 1/17/92, Daily maximum of 22,000 tons/day, daily avg. 18,200 tons/day with the following split:

Source:	Daily Maximum	Daily Average
BF#4 Casthouse	5,300 tons/day	4,800 tons/day
BF#6 Casthouse	5,300 tons/day	4,400 tons/day
BF#7 Casthouse	0 tons/day (swing furnace)	0 tons/day (swing furnace)
BF#8 Casthouse	4,320 tons/day	0 tons/day (swing furnace)
BF#13 Casthouse	10,500 tons/day	9,000 tons/day

(3) From 12/6/89 IDEM emission inventory, PM-10 % of 0.51 for casthouses and 0.74 for iron desulfurization from AP-42.
(4) Short-term emission rate represents a maximum hourly emission rate based on maximum hourly production.
(5) Long-term emission rate represents an average hourly emission rate based on maximum annual production.

Table B-6
PM-10 Emission Rates
USS Gary Works – BOP Shop

Source	Modeling Inventory No.	PM-10 Emission Factor		Throughput(1) Hourly Max.	Throughput(1) Hourly Avg.	Control Device (2)	ST Emission Rate (lb/hr) (3)	LT Emission Rate (lb/hr) (4)
BOP Gas Cleaning	94045	—		447.9 tons steel/hr	404.8 tons steel/hr	Process Venturi	34.4	27.8
BOP Roof Monitor	94113-4	**Process: (5)**		447.9 tons steel/hr	404.8 tons steel/hr	None	52.9	47.8
		Charging	0.021 lb/ton steel					
		Tapping	0.044 lb/ton steel					
		Hot Metal Trans.	0.011 lb/ton steel					
		Caster	0.014 lb/ton steel					
		Primary Fug.	0.028 lb/ton steel					
		Total	**0.118 lb/ton steel**					
Iron Desulfurization	94041	—		—	—	Baghouse	9.3	8.4
						Total PM-10 Emission Rate	96.6	84.0

(1) Per ENSR meeting with USS, 1/17/92, Two of three steel making vessels operational at one time. Throughputs shown are based on maximum QBOP operation. Daily maximum throughput is 10,750 tons/day, daily average throughput is 9,715 tons/day.

(2) From 12/6/89 IDEM emission Inventory.

(3) Short-term emission rate represents a maximum hourly emission rate based on maximum hourly production. Gas cleaning emission rates from IDEM 1981 stack test.

(4) Long-term emission rate represents an average hourly emission rate based on maximum annual production. Gas cleaning emission rates from IDEM 1981 stack test.

(5) Emission factors derived from the following, Also see Appendix C.

Process:	How Derived:
Charging	AP-42 emission factor of 0.142 lb/ton steel, assuming 60% of TSP is PM-10 and a Gaw damper control efficiency of 80%. Includes emissions due to scrap charging.
Tapping	AP-42 emission factor of 0.290 lb/ton steel, assuming 75% of TSP is PM-10 and a fume suppression control efficiency of 80%.
Hot Metal Trans.	AP-42 emission factor of 0.056 lb/ton steel, assuming 100% of TSP is PM-10 and a fume suppression control efficiency of 80%.
Continuous Caster	Same emission factor as Q-BOP continuous caster.
Primary Fug.	34.4 lb/hr PM-10 controlled emission rate out scrubber stack, scrubber efficiency of 95%, 500 ton/hr steel production, and open hood 98% capture efficiency.

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Table B-7
PM-10 Emission Rates
USS Gary Works– QBOP Shop

Source	Modeling Inventory No.	PM-10 Emission Factor		Throughput (1) Hourly Max.	Throughput (1) Hourly Avg.	Control Device (2)	ST Emission Rate (lb/hr) (3)	LT Emission Rate (lb/hr) (4)
QBOP Gas Cleaning	94046		0.058 lb/ton steel (5)	552.1 tons steel/hr	440.4 tons steel/hr	Process Venturi	32.0	25.5
QBOP Roof Monitor	94115	Process: (6)		552.1 tons steel/hr	440.4 tons steel/hr	—	92.5	73.8
		Charging	0.1147 lb/ton steel					
		Tapping	0.0035 lb/ton steel					
		HMT Mixer	0.0019 lb/ton steel					
		HMT Ladle	0.0006 lb/ton steel					
		Teeming	0.0050 lb/ton steel					
		Primary Fug.	0.0245 lb/ton steel					
		Caster	0.0140 lb/ton steel					
		HMD	0.0034 lb/ton steel					
		Total	0.1676 lb/ton steel					
HMD Baghouse	94042	—		—	—	Baghouse	11.5	11.5
Lime Baghouse	94043	—		—	—	Baghouse	2.6	2.6
Proposed QBOP Baghouse	94052	—		—	—	Baghouse	25.9	25.9
LMF Baghouse (old and new)	94054	—		—	—	Baghouse	2.9	2.9
					Total Uncontrolled PM-10 Emission Rate		141.6	116.4

(1) Per ENSR meeting with USS, 1/17/92, throughput based on maximum QBOP operation. Daily maximum throughput is 13,250 tons/day, daily average production is 10,570 tons/day.

(2) From 12/6/89 IDEM emission inventory.

(3) Short-term emission rate represents a maximum hourly emission rate based on maximum hourly production.

(4) Long-term emission rate represents an average hourly emission rate based on maximum annual production.

(5) Based on stack test of 6/6-7/91. Stack test TSP emission rate was 20.2 lb/hr with production of 466.2 tons steel/hr. Scaling this emission rate to account for an actual maximum production of 625 tons steel/hr results in an emission rate of 27.1 lb/hr. Assuming that 67% of TSP is PM-10, the PM-10 emission rate would be 18.2 lb/hr for one stack or 36.4 lb/hr for both stacks. Lowering this rate to account for the change in production values gives an emission rate of 32.0 lb/hr. and an emission factor of 0.058 lb/ton.

(6) Per ENSR meeting with USS, 1/17/92. Emission factors and rates are uncontrolled. See Appendix C for derivation and listing of uncontrolled and controlled emission rates.

Table B-8
PM-10 Emission Rates
USS Gary Works – Boilers

Source	Modeling Inventory No.	Total Heat Input (MMBtu/hr)	PM-10 Emission Factor (lb/MMBtu) (1)	Control Device (2)	Control Efficiency (%)	ST Emission Rate (lb/hr) (3)
Boiler House #4	94012	1110	0.035554	None	—	39.5
TBBH #1-5	94051	1710	0.024500	None	—	41.9
TBBH #6	94050	675	0.024500	None	—	16.5
Coke Plant Boilers #4-5	94037	300	0.251100	Cyclone	86.7	10.0
Coke Plant Boiler #6	94038	150	0.025110	Cyclone	92.0	3.2
Coke Plant Boiler #7	94039	160	0.011000	None	—	1.8
160/210" Plate Mill Reheat	94014	500	0.008732	None	—	4.4
84" Hot Strip Mill Reheat	94017	1760	0.006302	None	—	11.1
84" Hot Strip Mill Blrs. #1-2	94018-19	370	0.011000	None	—	4.1
				Total PM-10 Emission Rate		132.4

Fuel Specific TSP Emission Factors:

Blast furnace gas (BFG) =	0.029	lb/MMBtu
Coke oven gas (COG) =	0.011	lb/MMBtu
Natural gas (NG) =	0.0029	lb/MMBtu
#6 Oil =	0.087	lb/MMBtu
Coal =	0.27	lb/MMBtu

(1) PM-10 emission factor derived using the above fuel specific emission factors and the following: (Based on Lake County SO2 SIP limits dated 2/14/92)

Source:	How Derived:
Boiler House #4	A worst case fuel split of 80% BFG and 20% #6 oil, and assuming 100% of TSP is PM-10 for BFG and 71% of TSP is PM-10 for #6 oil.
TBBH #1-5	A worst case fuel split of 75% BFG and 25% COG, and assuming 100% of TSP is PM-10 for BFG and COG.
TBBH #6	A worst case fuel split of 75% BFG and 25% COG, and assuming 100% of TSP is PM-10 for BFG and COG.
Coke Plant Boilers #4-5	A fuel use of 100% coal, and assuming 93% of TSP is PM-10 for coal.
Coke Plant Boiler #6	A fuel use of 100% coal, and assuming 93% of TSP is PM-10 for coal.
Coke Plant Boiler #7	A fuel use of 100% COG, and assuming 100% of TSP is PM-10 for COG.
160/210" Plate Mill Reheat	A worst case fuel split of 72% COG and 28% NG, and assuming 100% of TSP is PM-10 for COG and NG.
84" Hot Strip Mill Reheat	A worst case fuel split of 42% COG and 58% NG, and assuming 100% of TSP is PM-10 for COG and NG.
84" Hot Strip Mill Blrs. #1-2	A fuel use of 100% COG, and assuming 100% of TSP is PM-10 for COG.

(2) From 12/6/89 IDEM emission Inventory.
(3) Short-term maximum hourly emission rate derived from worst case fuel use.

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Table B-9
PM-10 Emission Rates
USS Gary Works – Miscellaneous Sources

Source	Modeling Inventory No.	Throughput/Capacity(1)	Control Device (1)	Control Efficiency (%)	ST Emission Rate (lb/hr) (1)
Torch Cutoff Machine	94131	1.93 MMBtu/hr	None	—	1.7
Slab Mill Keep Hot Frncs.	94132	48.0 MMBtu/hr	None	—	0.2
Plate Mill Slow Cool Frncs.	94133	64.0 MMBtu/hr	None	—	0.2
Beach Iron Fugitives	94155-56	—	None	—	9.7
Scrap Sizing	94557	—	None	—	2.7
			Total PM-10 Emission Rate		14.5

(1) Information from R. Harkov memo of 10/29/91.

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ENSR

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March 18, 1992

Mr. Shri Harsha
Office of Air Management
Indiana Department of Environmental Management
105 South Meridian Street
Indianapolis, IN 46206-6015

Subject: Detailed Explanation of the BOP and Q-BOP Roof Monitor PM_{10} Emission Estimates Developed for USS Gary Works

Dear Mr. Harsha:

ENSR Consulting and Engineering has developed the above referenced information as a result of our meeting on March 11, 1992 and in support of the overall Lake County PM_{10} Attainment Demonstration. We would like to point out to IDEM that for virtually every step in the BOP and Q-BOP roof monitor emission estimation process that involved engineering estimates, ENSR and/or Eichleay used conservative judgements that resulted in higher emission rates. Both ENSR and Eichleay evaluated each shop with their associated steel-making practices and current and proposed air pollution controls. Based on the availability of particulate emissions data for the various source operations present in the BOP and Q-BOP shops, our emission estimates are the most comprehensive that can be developed at the present time.

Based on our previous discussion regarding ENSR's and IDEM's emission estimation approaches, we would like point out four (4) issues which were addressed by ENSR for the BOP and Q-BOP roof monitor estimates, but not by IDEM:

1: **Source vs Monitor Emissions:** Only fugitive emissions out of the BOP and Q-BOP roof monitors can impact ambient air. Data provided in AP-42 and other technical sources indicate that buildings definitively have an impact on the mass emission rates of particles released out of openings (i.e. roof monitors) during indoor materials processing operations. ENSR and Eichleay used conservative estimates to determine emissions **at the monitor** for both steel making shops. For example, hot metal charging monitor/source emission factor ratios are 0.2387 (AP-42, Supplement A Table 7.5-1) for BOP shops. No such data exists for Q-BOP shops so **Eichleay effectively doubled** the BOP monitor/source emission factor ratios to

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0.48 for the Q-BOP shop at Gary Works. This approach is conservative, i.e. it overpredicts emission rates.

2: **PM_{10} Splits:** Where PM_{10} split data existed only at the source or uncontrolled, ENSR and/or Eichleay assumed that **a higher percentage of PM_{10}** would exit out of the monitor. For example, for BOP tapping, ENSR used a PM_{10} percentage (at the monitor) of 75%. Information in AP-42, Supplement A, Table 7.5-2 indicates that the PM_{10} percentage at the source is 45%. This approach is conservative, i.e. it overpredicts emission rates.

3: **Primary Fugitives:** Published emission factors for primary fugitive emissions from BOP and Q-BOP facilities do not exist. ENSR and Eichleay developed emission estimates for primary fugitives based on Gary Works scrubber stack test results for the BOP and Q-BOP and reasonable assumptions regarding the existing and proposed control and capture efficiencies for the two sources. The ENSR and Eichleay emission estimates were derived based on our knowledge of the capture and control systems at both shops and we conclude that they are the best available for these operations.

4: **Emission Factors Based on Hot Metal Charged:** ENSR used emission factors for specific operations which are based on hot metal charged (charging, and hot metal transfer) and applied the emission factors on **a ton of steel produced** basis. We used this approach for two reasons. First, it is conservative, i.e. it overpredicts emission rates from these operations by approximately 20% to 25%. Approximately 80% of the metal charged to the ladles at Gary Works is hot metal. By doing so, we also felt that we **more than adequately** covered minor, uninventoried sources that contribute to fugitive emissions from the BOP and QBOP. Second, it simplified our evaluation of different production limits in the steel making shops with regard to the attainment demonstration. This was the case since this approach allowed ENSR to have a single, total roof monitor emission factor for each shop that was based soley on steel production.

We have attached relevant portions of cited documents in the attached calculations for your use. ENSR would be pleased to answer any questions you may have regarding the BOP and Q-BOP roof monitor emission estimates. Best regards.

Sincerely,

Ronald Harkov, Ph.D.	William Kubiak	Richard Dworek
Air Toxics Program Manager	Manager of	Director
	Environmental Compliance	Environmental Control

Attachments

cc. T. Method
M. Dennis
D. Johnson

ENSR Doc. No. 6975-040-800, B1

BOP ROOF MONITOR PM_{10} FUGITIVES

I - Charging

A: **Data/Assumptions** — **Source**

1) 0.142 lb TSP/ton hot metal at monitor — AP-42, Supp A, Table 7.5-1

(Note: ENSR used an emission factor based on **steel made, not hot metal charged**, or 0.142 lb TSP/t steel)

2) PM_{10} split - 60% — ENSR Engineering Estimate

(Note: Table 7.5-2 AP-42, Supp A, indicates PM_{10} split at source, 46%)

3) Gaw Damper Control Efficiency, 80% — USS Engineering Estimate, based on improved operating practice, i.e. steelmaking vessel 6° closer to hood

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the monitor), a conservative PM_{10} split and the uncontrolled release from the Gaw Damper, or:

I: Uncontrolled TSP Emission Factor = 0.142 lb/t TSP, at monitor;
II: Conservative PM_{10} split = 60%, or 0.6; and
III: Uncontrolled release = 1-0.8, or 0.2.

Thus;

(0.142 lb/t TSP, at monitor) * (0.60, PM_{10} split) * (0.2, uncont release) =

0.01704 lb PM_{10}/t steel or by rounding, 0.017 lb PM_{10}/t steel

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II - Tapping

A: **Data/Assumptions** — **Source**

1) 0.29 lb TSP/ton steel at monitor — AP-42, Supp A, Table 7.5-1

(Note: Alloy additions to the ladles no longer takes place, thus the AP-42 teeming emission factor is more appropriate for this source. However, ENSR used the tapping emission factor which results in **an overprediction of tapping emissions**)

2) PM_{10} split - 75% — ENSR Engineering Estimate, based on fume suppression controls

(Note: Table 7.5-2 AP-42, Supp A, indicates PM_{10} split at source, 45%)

3) Fume Suppression Control Efficiency, 80% — USS Engineering Estimate

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the monitor), a conservative PM_{10} split and the uncontrolled release from fume suppression, or:

I: Uncontrolled TSP Emission Factor = 0.29 lb/t TSP, at monitor;
II: Conservative PM_{10} split = 75%, or 0.75; and
III: Uncontrolled release = 1-0.8, or 0.2.

Thus;

(0.29 lb/t TSP, at monitor) * (0.75, PM_{10} split) * (0.2, uncont release) =

0.0435 lb PM_{10}/t steel or by rounding, 0.044 lb PM_{10}/t steel

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III - Hot Metal Transfer

A:	**Data/Assumptions**	**Source**
1)	0.056 lb TSP/ton hot metal at monitor	AP-42, Supp A, Table 7.5-1

(**Note:** ENSR used an emission factor based on **steel made, not hot metal charged**, or 0.056 lb TSP/t steel)

2)	PM_{10} split - 100%	ENSR Engineering Estimate, based on fume suppression controls
3)	Fume Suppression Control Efficiency, 80%	USS Engineering Estimate

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the monitor), a conservative PM_{10} split and the uncontrolled release from fume suppression, or:

- I: Uncontrolled TSP Emission Factor = 0.056 lb/t TSP, at monitor;
- II: Conservative PM_{10} split = 100%, or 1.0; and
- III: Uncontrolled release = 1-0.8, or 0.2.

Thus;

(0.056 lb/t TSP, at monitor) * (1.0, PM_{10} split) * (0.2, uncont release) =

0.0112 lb PM_{10}/t steel or by rounding, 0.011 lb PM_{10}/t steel

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IV - Primary Fugitives

A:	**Data/Assumptions**	**Source**
1)	Scrubber TSP Test, 51.2 lbs/hr TSP	1981 Stack Test
2)	Scrubber PM_{10} Split - 67%	AP-42, Supp A, Table 7.5-1

(**Note:** By applying the PM_{10} split based on **scrubber emissions,** ENSR is overpredicting primary fugitives since these uncaptured emissions will have lower PM_{10} percentage)

3)	Scrubber Control Efficiency, 95%	ENSR Engineering Estimate
4)	Open Hood Capture Efficiency, 98%	ENSR Engineering Estimate
5)	Steel Production Rate During Test, 500 TPhr	Lake County TSP SIP Maximum

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the controlled TSP emission rate (at the scrubber stack), the AP-42 PM_{10} split, an estimated control efficiency for the scrubber and an estimated open hood capture efficiency, or:

I: Controlled TSP Emission Rate = 51.2 lb/hr TSP;
II: AP-42 PM_{10} split = 67% or 0.67;
III: Uncontrolled release = 5% or 0.05; and
IV: Capture efficiency = 98% or 0.98.

Thus;

Step 1: Estimate Controlled PM_{10} Emission Rate

(51.2 lbs/hr TSP, at stack) * (0.67, PM_{10} split) =

34.304 lbs/hr, or rounded 34.4 lbs/hr PM_{10}

Step 2: Estimate Captured PM_{10} Emission Rate

(34.4 lbs/hr PM_{10}/0.05 cont release) =

688 lbs/hr PM_{10}

Step 3: Develop Captured PM_{10} Emission Factor

(688 lbs/hr PM_{10}/500 TPhr steel) =

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1.376 lbs PM_{10}/t steel

Step 4: Develop Uncontrolled PM_{10} Emission Factor

(1.376 lbs PM_{10}/t steel)/(0.98 capt release) =

1.404 lbs PM_{10}/t steel total release

Step 5: Estimate Uncaptured or Fugitive PM_{10} Emission Factor

(1.404 lbs PM_{10}/t steel) * (0.02 uncap release) =

0.02808 lbs PM_{10}/t steel, or rounded, 0.028 lbs PM_{10}/t steel

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V - Total BOP Fugitive PM_{10} Emission Factor

Source	PM_{10} Emission Factor, lbs/t steel
Charging	0.017
Tapping	0.044
Hot Metal Transfer	0.011
Primary Fugitives	0.028
Total	0.1

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Q-BOP ROOF MONITOR PM_{10} FUGITIVES

DEFINITIONS:

Current Conditions:	With new, hot metal desulfurization (HMD) baghouse and hot metal transfer (HMT) collection/controls
Proposed Conditions:	As current conditions, but with proposed secondary collection system with 900,000 cfm baghouse

==

I - Charging

A:	**Data/Assumptions**	**Source**
1)	0.35 lb TSP/ton hot metal, at source	Westbrook (1979 & 1980)
	(**Note:** ENSR used an emission factor based on **steel made, not hot metal charged**, or 0.35 lb TSP/t steel)	
2)	Approximate % of scrap charged at QBOP 20%	USS Plant Data
3)	Scrap charging is one-third (33%) as emissive as hot metal charging	USS Engineering Estimate
4)	BOP charging monitor/source emission factor ratio, 0.2367	AP-42, Supp A, Table 7.5-1
5)	QBOP charging monitor/source emission factor ratio, 0.48	Eichleay Engineering Estimate
6)	Westbrook (1979) 69% of charging emissions >10 μ at source, used PM_{10} split - 65%, at monitor	Eichleay Engineering Estimate
7)	Capture Efficiency of Proposed 2° Controls, 90%	Eichleay Engineering Estimate

B: **Emission Estimate**

Current Conditions:

To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the source), estimate a TSP scrap charging emission factor (at the source), develop a conservative estimate of release at the monitor, and apply a conservative PM_{10} split, or:

3

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I: Uncontrolled TSP Emission Factor = 0.35 lb TSP/t hot metal, at source;
II: Scrap charging amount 20%, or 0.2;
III: Relative emission rate of scrap charging to hot metal charging 33%, or 0.33;
IV: Conservative QBOP monitor/source emission factor ratio, 48%;
V: Conservative PM_{10} split = 65% or 0.65.

Thus;

Step 1: Estimate Uncontrolled TSP Scrap Charging Emission Factor, at Source

(0.35 lb TSP/t steel, at source) * (0.20, % scrap charged) * (0.33, rel emission rate) =

0.023 lb/t of steel for scrap charging

Step 2: Develop Uncontrolled TSP Charging Emission Factor, at Source

(0.35 lb/t) + (0.023 lb/t) = 0.373 lb/t, rounded to 0.37 lb/t

(**Note:** a 0.37 lb/t steel TSP emission factor as developed is roughly equivalent to a 0.46 lb/t hot metal charged TSP emission factor, i.e. (0.37 lb/t)/(0.8) = 0.46 lb/t)

Step 3: Estimate Uncontrolled PM_{10} Emission Factor, at Monitor

(0.37 lb TSP/t steel, at source) * (0.48, QBOP monitor/source ratio) * (0.65, PM_{10} split) =

0.115 lb PM_{10}/t steel emission factor, at the monitor

Proposed Conditions:

To develop this emission estimate it was necessary to use the above PM_{10} emission factor (0.115 lb/t steel) and apply a capture efficiency to determine the **uncaptured release** for the proposed secondary controls, or:

I: Capture Efficiency, 90%, or 0.9; and,
II: Uncaptured Release 1-0.9, or 0.1.

Thus;

Step 1: Estimate Uncaptured PM_{10} Emission Factor, at Monitor

(0.115 lb PM_{10}/t) * (0.1, uncapt release) = 0.0115 lb PM_{10}/t steel

II - Tapping

A:	Data/Assumptions	Source
1)	Alloy additions do not take place in ladles	USS Plant Data
2)	Since metallurgy at the QBOP does not occur in the ladles, tapping is more similar to teeming, the teeming emission factor 0.07 lb TSP/t, at the source, was used for tapping	Eichleay Engineering Estimate (AP-42, Supp A, Table 7.5-1)
3)	PM_{10} split - 100%	Eichleay Engineering Estimate,
4)	Existing Open-hood Capture Efficiency, 95%	Eichleay Engineering Estimate
5)	Proposed QBOP 2° Capture Efficiency, 50%	Eichleay Engineering Estimate

B: **Emission Estimate**

Current Conditions:

To develop this emission estimate it was necessary to use the uncontrolled teeming TSP emission rate (at the source), a conservative PM_{10} split, and the capture efficiency of the open hood, or:

I: Uncontrolled TSP Emission Factor = 0.07 lb/t TSP, at source;
II: Conservative PM_{10} split = 100% or 1.0; and
III: Uncaptured release = 5% or 0.05.

Thus;

(0.07 lb/t TSP, at source) * (1.0, PM_{10} split) * (0.05, uncapt release) =

0.0035 lb PM_{10}/t steel

Proposed Conditons:

To develop this emission estimate it was necessary to use the new capture efficiency of the proposed secondary controls, or:

I: Uncaptured release = 50% or 0.5.

Thus;

(0.0035 lb/t steel) * (0.5, uncont release) =

0.00175 lb PM_{10}/t or rounded to 0.0018 lb PM_{10}/t steel

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IIIa - Hot Metal Transfer: Mixer

A:	**Data/Assumptions**	**Source**
1)	0.19 lb TSP/ton hot metal at source	AP-42, Supp A, Table 7.5-1
	(Note: ENSR used an emission factor based on **steel made, not hot metal charged**, or 0.19 lb TSP/t steel)	
2)	PM_{10} split - 50%, MRI (1978) study indicates 16% PM_{10} at source	Eichleay Engineering Estimate,
3)	New HMD system Capture Efficiency, 98%	Eichleay Engineering Estimate

B: **Emission Estimate**

Hot metal transfer to the mixer occurs in an area (outside melt shop) in which a significant loss of PM_{10} before exiting the shop through the roof monitor does not occur. To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the source), a conservative PM_{10} split and the uncaptured release from the new HMD collection hood, or:

I: Uncontrolled TSP Emission Factor = 0.19 lb/t TSP, at source;
II: Conservative PM_{10} split = 50% or 0.5; and
III: Uncaptured release = 2% or 0.02.

Thus;

(0.19 lb/t TSP, at source) * (0.5, PM_{10} split) * (0.02, uncapt release) =

0.0019 lb PM_{10}/t steel

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IIIb - Hot Metal Transfer: Ladle

A:	**Data/Assumptions**	**Source**
1)	0.19 lb TSP/ton hot metal at source	AP-42, Supp A, Table 7.5-1
	(Note: ENSR used an emission factor based on **steel made, not hot metal charged**, or 0.19 lb TSP/t steel)	
2)	PM_{10} split - 50%, MRI (1978) study indicates 16% PM_{10} at source	Eichleay Engineering Estimate,
3)	New HMD system Capture Efficiency, 98%	Eichleay Engineering Estimate
4)	BOP monitor/source split for TSP HMT is (0.056 lb/t)/(0.19 lb/t), or, 29.5%.	AP-42, Supp A, Table 7.5-1
5)	For QBOP monitor/source assumed split is same as BOP or 29.5%	Eichleay Engineering Estimate

B: **Emission Estimate**

Hot metal transfer to the ladle occurs in the melt shop area, thus a significant loss of PM_{10} before exiting the shop through the roof monitor does occur. To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the source), a conservative PM_{10} split, the uncaptured release from the new HMD collection hood and an estimate of the monitor/source split, or:

I: Uncontrolled TSP Emission Factor = 0.19 lb/t TSP, at source;
II: Conservative PM_{10} split = 50% or 0.5;
III: Uncaptured release = 2% or 0.02; and,
IV: Monitor/source, 29.5% or 0.295.

Thus;

(0.19 lb/t TSP, at source) * (0.5, PM_{10} split) * (0.02, uncapt release) * (0.295, monitor/source split) =

0.00056 lb PM_{10}/t steel, or rounded 0.0006 lb PM_{10}/t steel

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IV - Primary Fugitives

A:	**Data/Assumptions**	**Source**
1)	Scrubber TSP Test, 0.0866 lb TSP/t steel	1991 Stack Test, submitted to IDEM July 1991
2)	Scrubber PM_{10} Split - 67%	AP-42, Supp A, Table 7.5-1

(**Note:** By applying the PM_{10} split based on **scrubber emissions**, ENSR is overpredicting primary fugitives since these uncaptured emissions will have lower PM_{10} percentage)

3)	Scrubber Control Efficiency, 95%	Eichleay Engineering Estimate
4)	Open Hood Capture Efficiency, 98%	Eichleay Engineering Estimate
5)	Proposed QBOP 2° Capture Efficiency, 80%	Eichleay Engineering Estimate

B: **Emission Estimate**

Current Conditions:

To develop this emission estimate it was necessary to use the controlled TSP emission factor (at the scrubber stack), the AP-42 PM_{10} split, an estimated control efficiency for the scrubber and an estimated open hood capture efficiency, or:

I: Controlled TSP Emission Rate = 0.0866 lb/t TSP;
II: AP-42 PM_{10} split = 67% or 0.67;
III: Uncontrolled release = 5% or 0.05; and
IV: Capture efficiency = 98% or 0.98.

Thus;

Step 1: Estimate Controlled PM_{10} Emission Factor

(0.0866 lbs TSP /t, at stack) * (0.67, PM_{10} split) =

0.058 lbs PM_{10}/t steel

Step 2: Estimate Captured PM_{10} Emission Factor

(0.058 lbs/t PM_{10}/0.05 capt release) =

1.16 lbs PM_{10}/t steel

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Step 3: Estimate Uncontrolled PM_{10} Emission Factor

(1.16 lbs PM_{10}/t)/(0.98) =

1.18 lbs PM_{10}/t steel

Step 4: Estimate Uncaptured or Fugitive PM_{10} Emission Factor

(1.18 lbs PM_{10}/t steel) * (0.02 uncap release) =

0.0237 lbs PM_{10}/t steel or rounded, 0.024 lbs PM_{10}/t steel

Proposed Conditions:

To develop this emission estimate it was necessary to use the above PM_{10} emission factor (0.024 lb/t steel) and apply a capture efficiency to determine the **uncaptured release** for the proposed secondary controls, or:

I: Capture efficiency = 80%, or 0.8; and,
II: Uncaptured release = 1-0.8, or 0.2.

Thus;

Step 1: Estimate Uncaptured or Fugitive PM_{10} Emission Factor

(0.024 lbs PM_{10}/t steel) * (0.2 uncap release) =

0.0048 lbs PM_{10}/t steel

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VI - Caster Fugitives

A:	**Data/Assumptions**	**Source**
1)	0.014 lbs TSP/t of steel	USS Permit Submittal to IDEM
2)	PM_{10} split - 100%	ENSR Engineering Estimate

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the uncontrolled TSP emission rate (at the source), and a conservative PM_{10} split

I: Uncontrolled TSP Emission Factor = 0.014 lb TSP/t, at source;
II: Conservative PM_{10} split = 100% or 1.0.

Thus;

(0.014 lbs TSP/t steel) * (1.0, PM_{10} split) = 0.014 lbs PM_{10}/t steel

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VII - New QBOP HMD System Fugitives

A:	**Data/Assumptions**	**Source**
1)	Lorain Works uncontrolled HMD emission factor, 0.42 lbs TSP/t steel	Lorain Works Test Data
2)	New QBOP HMD hood capture efficiency, 98%	Eichleay Engineering Estimate
4)	PM_{10} split - 40%, at source	Eichleay Engineering Estimate

(**Note:** AP-42, Supp A, Table 7.5.2, indicates that the PM_{10} split for HMD emissions, at the source, is 19%)

B: **Emission Estimate**

To develop this emission estimate it was necessary to use the uncontrolled TSP emission factor at the Lorain Works, and an estimated capture efficiency at the new QBOP HMD system, and a conservative PM_{10} split, or:

I: Controlled TSP Emission Factor = 0.42 lb TSP/t steel;
II: Capture efficiency = 98% or 0.98;
III: Uncaptured release = 1-0.98, or 0.02; and
IV: Conservative PM_{10} split = 40%, or 0.4;

Thus;

Step 1: Estimate Uncaptured TSP Emission Factor

(0.42 lb TSP/t steel) * (0.02, cont release) =

0.0084 lb TSP/t of steel

Step 2: Estimate Uncaptured or Fugitive PM_{10} Emission Factor

(0.0084 lbs TSP/t steel) * (0.4, PM_{10} split) = 0.0034 lbs PM_{10}/t,

000081

V - Total Q-BOP Fugitive PM_{10} Emission Factor

Current:

Source	PM_{10} Emission Factor, lbs/t steel
Charging	0.115
Tapping	0.0035
HMT Mixer	0.0019
HMT Ladle	0.0006
Primary Fugitives	0.024
Caster	0.014
HMD	0.0034
Total	0.1624

Proposed:

Source	PM_{10} Emission Factor, lbs/t steel
Charging	0.0115
Tapping	0.0018
HMT Mixer	0.0019
HMT Ladle	0.0006
Primary Fugitives	0.0048
Caster	0.014
HMD	0.0034
Total	0.038

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